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Investigating the role of blood types in 171 patients with tinea pedis and onychomycosis

Tinea pedis ve onikomikozlu 171 hastada kan gruplarının rolünün araştırılması

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ABSTRACT

Introduction: Superficial fungal infections, which are considered as the most common risk factor for mucocutaneous infections, are still an important consideration of human health. Tinea pedis and onychomycosis are two common types of superficial fungal infections. Increased recurrence of these infections in certain subjects led us speculate the common factors that might contribute to our observations. In this study, we aimed to investigate the relationship between blood types and two types of fungal infections tinea pedis and onychomycosis.

Material and Method: In our study, we questioned blood types of 171 tinea pedis and onychomycosis patients, who applied to our clinic between October 2015 and December 2016. Diagnoses were confirmed using mycotic examination and fungal cultures. We measured patients' hemogram, alanine aminotransferase, aspartate aminotransferase, urea and creatinine levels to determine their treatments. Patients were monitored during their treatments.

Results: We analyzed our results to determine the effectiveness of treatments, recurrence, and the relationship between our result and patients' blood types. We could not find any significant relation between blood types and gender, educational status, residence addresses of patients, infected region, duration of fungal infection ($p>0.05$). Then we could not find also a significant relation between blood types of the patients and infection status of the family members that patients lived together with ($p>0.05$).

Conclusion: Our study shows that AB0 blood types are not significantly correlated with neither tinea pedis nor onychomycosis, which are dermatophytes, causing superficial fungal infections.

Keywords: Tinea pedis, onychomycosis, blood types

ÖZ

Giriş: Mukokutanöz enfeksiyonlar için en yaygın risk faktörü olarak kabul edilen yüzeysel mantar enfeksiyonları, insan sağlığı için hala önemli bir husustur. Tinea pedis ve onikomikoz iki yaygın yüzeysel mantar enfeksiyonu türüdür. Bazı konularda bu enfeksiyonların artan tekrarlaması, gözlemlerimize katkıda bulunabilecek ortak faktörleri speküle etmemize yol açtı. Bu çalışmada iki tip mantar enfeksiyonu olan tinea pedis ve onikomikoz arasındaki ilişkiyi araştırmayı amaçladık.

Gereç ve Yöntem: Çalışmamızda Ekim 2015-Aralık 2016 tarihleri arasında kliniğimize başvuran 171 tinea pedis ve onikomikoz hastalarının kan tiplerini sorguladık. Mikolojik muayene ve mantar kültürleri kullanılarak tanı konuldu. Tedavilerini belirlemek için hastaların hemogramı, alanin aminotransferaz, aspartat aminotransferaz, üre ve kreatinin düzeylerini ölçtük. Hastalar tedavileri sırasında izlendi.

Bulgular: Tedavilerin etkinliğini, nüksünü ve sonucumuz ile hastaların kan grupları arasındaki ilişkiyi belirlemek için sonuçlarımızı analiz ettik. Kan grupları ile cinsiyet, kan gruplarıyla eğitim durumu, kan gruplarıyla hastaların yaşadığı bölge, kan gruplarıyla enfekte bölge,kan gruplarıyla mantar enfeksiyonunun süresi arasında anlamlı bir ilişki bulamadık ($p>0,05$). Daha sonrasında kan gruplarıyla, beraber yaşadıkları aile üyelerinin enfeksiyon durumu arasında da anlamlı bir ilişki bulamadık.

Sonuç: Çalışmamız, AB0 kan tiplerinin yüzeysel mantar enfeksiyonlarına neden olan dermatofitler olan ne tinea pedis ne de onikomikoz ile anlamlı bir ilişki içinde olmadığını göstermektedir.

Anahtar Kelimeler: Tinea pedis, onikomikoz, kan tipleri

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INTRODUCTION

Among mucocutaneous infections, superficial infections are considered as the most frequently observed one. There are three types of fungi causing superficial infections: dermatophytes, candida species, and Malassezia furfur. Dermatophytes are the only fungal group known to infect keratinized cutaneous structures such as stratum corneum, nails, and hair. Infections caused by dermatophytes are termed as dermatophytosis and can be further classified based on the type of tissue infected: dermatophytosis of epidermis (epidermomycosis), dermatophytosis of hair and hair follicles (trichomycosis), and dermatophytosis of the nail (onychomycosis). Epidermomycosis, trichomycosis, and onychomycosis are considered as clinically different since they affect different anatomical structures. The term tinea is generally equated with dermatophytes and it is used in conjunction with the anatomical name of the site of infection (e.g. tinea pedis) (1).

Tinea pedis is a dermatophyte infection that is characterized by erythema, squama, maceration, and formation of a bulla on foot (1). Tinea pedis and tinea manuum are generally associated with tinea unguium (onychomycosis). In onychomycosis, fungal infection develops under the nail plate, at the nail fold or distally, and eventually involves the nail bed. Circulatory disorders, neuropathy, immune abnormalities, and diabetes mellitus are predisposing factors of tinea unguium (2). Onychomycosis is considered as the hardest form of dermatophytosis to treat, especially if the infection site is toe nail (3).

Agglutination of erythrocytes based on antigen-antibody interactions forms the basis of blood type determinations. Antigens are found on erythrocytes, while antibodies are present in plasma. There are more than 300 antigens are identified on the surface of human erythrocytes. Among these antigens, ~213 of them are found to be related to blood types. Since it was first discovered by Karl Landsteiner in 1901, there are more than 21 blood type systems described.

In the AB0 system, there are four main blood types (A, B, AB, and 0) and their subtypes are defined. These types are based on the presence of A, B, and H antigens in erythrocytes. A, B, and H antigens are glycoproteins that can also be found in other tissue cells and body fluids like sperm, milk, saliva, gastric juice, sweat, etc. (4). The serum contains antibodies against the antigens, which are mainly in the IgM structure. However, the antibodies in a blood sample are not against the antigens present on the surface of the erythrocytes of that blood sample. For example, a person with blood type A contains anti-B (β), a person with blood type B contains anti-A (α) and a person with blood type 0 contains both anti-A and anti-B antibodies in their serum (4).

Landsteiner and Wiener first showed that the antiserum obtained by giving rabbits erythrocytes isolated from Macacus Rhesus agglutinates 85% of human erythrocytes. These antigens are called Rh antigens. Later, it was understood that these antigens are D antigens, which have the highest antigenicity after A and B antigens. Since D antigens are the strongest in the Rh system, erythrocytes that agglutinate with anti-D are called "Rh positive" while the ones that do not agglutinate with anti-D are called "Rh negative" (5).

MATERIAL AND METHOD

The study was carried out with with the permission of Lokman Hekim University, Noninvasive Clinical Ethics Committee (Decision No:2020/78). All procedures were performed adhered to the ethical rules and the Helsinki Declaration of Principles.

One hundred seventy-one (171) patients with tinea pedis and onychomycosis applied to our clinic between October 2015 and December 2016. We obtained an informed consent form from all the patients who participated in our study. Patients were diagnosed with tinea pedis and onychomycosis, which were confirmed by dermatological examination, mycotic examination, and mycotic culture tests.

Patients were examined for other systemic diseases through systemic examination. As a result, we identified 7 patients with cardiovascular disease (CVD), 10 patients with hypertension, 2 patients with gastrointestinal diseases, 10 patients with Sjörgen syndrome, 2 patients with diabetes mellitus. Also, we measured blood types, hemograms, sedimentation, alanine aminotransferase (ALT), aspartate aminotransferase (AST), urea, and glucose levels in patients' blood samples. Only three patients with a glucose level of 150-200 were suspected of having diabetes. Patients were directed to necessary clinics based on their health problems.

We grouped the patients according to their blood types. Their antimycotic treatments were determined based on the status of their mycotic infection (level of infection, prevalence, previous treatments, risk of recurrence, prevalence within the family, etc.). We followed the results and success of the treatment, its recurrence among the patient groups, and groups' resistance to the treatment for a year.

RESULTS

Eighty seven of our patients identify as female while 84 of them were identify as male. Their ages varied between 15 and 73. A high rate of tinea pedis and tinea unguium were observed after clinical examination (**Table 1**). Occurrence of mycotic infections in other anatomical

regions was lower. Educational status of patients varied from illiterate to higher education. We also grouped patients based on their employment status. Patients who were employed had various professions such as officer, farmer, worker, bureaucrat, teacher etc. However, unemployed patients were mainly housewives, students and retirees. Additionally, we found that the rate of married patients was higher compared to unmarried patients. We investigated whether the family members that live together with the patients were infected as well. Patients were grouped based on their residential addresses (**Table 2**). We found that duration of the fungal disease varied between the patients. Patients were grouped based on the duration of their disease (**Table 3**). Patients were grouped based on the previous treatments they received, recurrence of their infections and their blood types. We ignored Rh factor while grouping (**Table 4-6**). Treatments were determined based on clinical conditions of the patients, their progress were tracked and checked.

Table 1. Types of fungal infections found in the study

Fungal infection	Number	Percentage (%)
Tinea pedis-tinea unguium	155	90.6
Tinea manum-Tinea cruris	16	9.4
Total	171	100

Table 2. Residential addresses of the patients

Residence	Number	Percentage (%)
Diyarbakir	111	64.9
Other	60	35.1
Total	171	100

Table 3. Duration of patients' infections

Duration of infection	Number	Percentage (%)
0-1 year	56	32.7
2-19 years	94	55
≥20 years	21	12.3
Total	171	100

Table 4. Previous treatments received by patients

Previous treatment	Number	Percentage (%)
Untreated	76	44.4
Local treatment	86	50.3
Oral – Local treatment	9	5.3
Total	171	100

Table 5. Status of recurrence of infections in patients

Recurrence	Number	Percentage (%)
Recurred	78	45.6
Not recurred	93	54.4
Total	171	100

Table 6. Blood type of patients

Blood type	Number	Percentage (%)
Type 0	45	26.3
Type A	83	48.5
Type B	25	14.6
Type AB	18	10.5
Total	171	100

Among the 171 tinea pedis and tinea unguium patients included in our study, 83 of the patients had blood type A, 45 of the patients had blood type 0, 25 of the patients had blood type B and 18 of the patients had blood type AB. Tables above investigated the correlations between gender and educational status of the patients and their blood types. Statistical comparisons are made using Chi-square tests. However, they did not result in any significant relation. However, the statistical tests did not result in a significant correlation. We showed our results as tables below. We showed our results as tables (**Table 7-20**) below.

Table 7. Number of treatment courses patients received to eliminate infection

Treatment Results	Number	Percentage (%)
One course of treatment	121	70.8
Two courses of treatment	40	23.4
Three courses of treatment	10	5.8
Total	171	100

Table 8. Treatment methods used in the study

Treatment	Number	Percentage (%)
Oral	148	86.5
Local	23	13.5
Total	171	100

Table 9. Cross tabulation blood types and gender

Blood types	Gender		Total
	Male	Female	
Type 0	26	19	45
Type A	41	42	83
Type B	10	15	25
Type AB	7	11	18
Total	84	87	171

Table 10. Statistical comparison of the values presented at **Table 14**

Chi-Square Tests	Value	Degree of freedom (df)	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.938[a]	3	0.401
Likelihood Ratio	2.956	3	0.398
Linear-by-Linear Association	2.752	1	0.097
N of Valid Cases	171		

[a]We used Chi-square test for statistical comparison. We could not find a significant relation between blood types and gender P>0.05

Table 11. Cross tabulation of blood type and educational status

Blood types	Educational Status				Total
	Illiterate	Primary Education	Secondary Education	Higher Education	
Type 0	4	17	13	11	45
Type A	7	34	25	17	83
Type B	1	11	8	5	25
Type AB	2	4	8	4	18
Total	14	66	54	37	171

[a]We used Chi-square test for statistical comparison. We could not find a significant relation between blood types and educational status P>0.05

Table 12. Statistical comparison of the values presented at **Table 16**

Chi-Square Tests	Value	Degree of freedom (df)	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.677[a]	9	0.931
Likelihood Ratio	3.892	9	0.918
Linear-by-Linear Association	0.096	1	0.757
N of Valid Cases	171		

Table 13. Cross tabulation of blood type and infection status of the family members that patients lived together with

Blood types	Infection status		Total
	Uninfected	Infected	
Type 0	28	17	45
Type A	57	26	83
Type B	19	6	25
Type AB	12	6	18
Total	116	55	171

Table 14. Statistical comparison of the values presented at **Table 18**

Chi-Square Tests	Value	Degree of freedom (df)	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.452[a]	3	0.693
Likelihood Ratio	1.475	3	0.688
Linear-by-Linear Association	0.557	1	0.455
N of Valid Cases	171		

[a]We used Chi-square test for statistical comparison. We could not find a significant relation between blood types of the patients and infection status of the family members that patients lived together with P>0.05

Table 15. Cross tabulation of blood type and residence addresses of patients

Blood Types	Residence		Total
	Diyarbakır	Other	
Type 0	28	17	45
Type A	56	27	83
Type B	14	11	25
Type AB	13	5	18
Total	111	60	171

Table 16. Statistical comparison of the values presented at **Table 20**

Chi-Square Tests	Value	Degree of freedom (df)	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.675[a]	3	0.642
Likelihood Ratio	1.665	3	0.645
Linear-by-Linear Association	0.081	1	0.776
N of Valid Cases	171		

[a]We used Chi-square test for statistical comparison. We could not find a significant relation between blood types and residence addresses of patients P>0.05

Table 17. Cross tabulation of blood type and infected region

Blood Types	Site of Infection		Total
	Toenail	Other	
Type 0	41	4	45
Type A	76	7	83
Type B	23	2	25
Type AB	15	3	18
Total	155	16	171

Table 18. Statistical comparison of the values presented at **Table 22**

Chi-Square Tests	Value	Degree of freedom (df)	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.283[a]	3	0.733
Likelihood Ratio	1.096	3	0.778
Linear-by-Linear Association	0.523	1	0.470
N of Valid Cases	171		

[a]We used Chi-square test for statistical comparison. We could not find a significant relation between blood types and infected region P>0.05

Table 19. Cross tabulation of blood type and duration of infection

Blood Types	Duration of infection			Total
	0-1 year	2-19 years	≥20 years	
Type 0	12	29	4	45
Type A	26	43	14	83
Type B	11	12	2	25
AB Type	7	10	1	18
Total	56	94	21	171

Table 20. Statistical comparison of the values presented at **Table 24**

Chi-Square Tests	Value	Degree of freedom (df)	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.721[a]	6	0.455
Likelihood Ratio	5.743	6	0.453
Linear-by-Linear Association	1.639	1	0.201
N of Valid Cases	171		

[a]We used Chi-square test for statistical comparison. We could not find a significant relation between blood types and duration of fungal infection P>0.05

DISCUSSION

Fungal infections have various predisposing factors, especially the fungal infections that are very common in the general population such as tinea pedis and tinea unguium. In our study, we investigated whether blood type is a potential risk factor for tinea pedis and tinea unguium. Tinea pedis is the most common type of dermatophytes. It progresses as itching between the toes, maceration, and flaking (6). Previous studies conducted in Turkey show that, even though there are some differences, tinea pedis is the most common type of dermatophytes. Metin and his colleagues (6) found that 14% of 7231 patients they examined around the Van region had superficial fungal infections. 80.98% of their patients diagnosed with superficial fungal infections had dermatophytes and 45% of dermatophytes are identified as tinea pedis (7). Another study conducted by Bilgili and

his colleagues (8) at the Eskişehir region found that 45% of their patients had tinea pedis. Populations investigated in developed countries show onychomycosis rates changing between 3% and 8%, and these rates increase with age (9, 10). Onychomycosis is characterized by thickening, hardening, discoloration, and onycholysis of nails. It is considered as the most common nail disease and it constitutes 20-50% of the nail diseases. 80% of onychomycosis cases are found to be affecting toenails (11). Recent studies explored the relation between AB0 blood types and susceptibility to infection, but the results were inconsistent (12). Kinane and his colleagues (12) reported that women with B or AB blood types are more susceptible to urinary infections. Also, other studies stated that having blood type 0 can be a risk factor for Candida albicans infection and its oral carriage (13,14). The frequency of superficial fungal infections can be varied by socio-economic and cultural differences. Incidence frequency of onychomycosis is reported as 2-5% within the population. Vascular diseases, atopy, obesity, diabetes mellitus, corticosteroid use, and sports activities are considered among the risk factors (15).

Dermatophytes require keratinized tissue for their growth and they invade tissues including skin, hair, and nails. Prevalence of dermatophyte infections changes based on geographical, climatic, socio-economic, and migration factors (16). Nalbant and his colleagues (16) investigated the relationship between vitamin D, C-reactive protein, hemogram parameters, and blood types. However, they could not detect any relationship between blood types, Rh positivity, and obesity. Another study conducted by Kahramanca and his colleagues investigated the effect of Rh antigen and AB0 blood types in cancer development. They showed that the prevalence of blood types A and B, as well as Rh antigen positivity is significantly higher among patients with colorectal cancer (CRC) (17,18). Our study shows that AB0 blood types are not significantly correlated with neither tinea pedis nor onychomycosis, which are dermatophytes causing superficial fungal infections.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with with the permission of Lokman Hekim University, Noninvasive Clinical Ethics Committee (Decision No:2020/78).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients..

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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